

**TABLE 1**  
**SUMMARY OF SSFL PERCHLORATE ANALYSES**  
**Santa Susana Field Laboratory**  
**January through May 2003**

<b>Sampling Program and Sample Type</b>	<b>Location of Sampling Program</b>	<b>Number of Samples</b>	<b>Number of Detections</b>
<b>RFI Soil</b>	Onsite	0	0
<b>RFI Soil Leachate</b>	Onsite	17	3
<b>Total Soil</b>		<b>17</b>	<b>3</b>
<b>RFI Surface Water</b>	Onsite	139	98
<b>NPDES Surface Water</b>	Onsite	37	4
<b>Total Surface Water</b>		<b>176</b>	<b>102</b>
<b>RFI Spring and Seep</b>	Offsite	1	0
<b>Near-Surface Groundwater Wells</b>	Onsite	61	17
<b>Onsite Chatsworth Formation Wells</b>	Onsite	56	3
<b>Offsite Chatsworth Formation Wells</b>	Offsite	27	0
<b>Chatsworth Formation - FLUTe</b>	Onsite	84	32
<b>Groundwater Treatment System</b>	Onsite	6	0
<b>Total Groundwater</b>		<b>235</b>	<b>52</b>
<b>TOTAL SAMPLES</b>		<b>428</b>	<b>157</b>
<b>Total Onsite Samples</b>		<b>400</b>	<b>157</b>
<b>Total Offsite Samples</b>		<b>28</b>	<b>0</b>

Onsite = Sampling program conducted within SSFL boundary.

Offsite = Sampling program conducted outside of SSFL boundary.

NPDES = National Pollutant Discharge Elimination System

FLUTe = Flexible Liner Underground Technology

**TABLE 2**  
**PERCHLORATE RESULTS FROM SURFACE WATER SAMPLES**  
**Santa Susana Field Laboratory**  
**January through May 2003**

**NPDES Outfalls 001 through 007, and Happy Valley (HV)**

<b>Date</b>	<b>Outfall</b>								
	<b>001</b>	<b>002</b>	<b>003</b>	<b>004</b>	<b>005</b>	<b>006</b>	<b>007</b>	<b>HV-1</b>	<b>HV-2</b>
2/11/2003	--	--	--	--	< 4.0	--	--	--	--
2/12/2003	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	<b>4.7</b>	< 4.0
2/25/2003	--	--	--	--	--	--	--	<b>12</b>	< 4.0
2/27/2003	--	< 4.0	--	< 4.0	< 4.0	< 4.0	--	--	--
3/15/2003	--	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	<b>5.3</b>	< 4.0
3/16/2003	< 4.0	--	--	--	--	--	--	--	--
4/14/2003	--	< 4.0	--	< 4.0	< 4.0	< 4.0	--	--	--
5/3/2003	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	<b>4.6</b>

All data in micrograms per liter (ug/L)

-- Not sampled/analyzed

**Bold** indicates detected concen

NPDES: National Pollutant Discharge Elimination

Source: Published in Boeing NPDES monitoring reports.

**TABLE 3**  
**SUMMARY OF DTSC’S WORK PLAN REQUIREMENTS AND PROPOSED SCOPE OF WORK**  
**Santa Susana Field Laboratory, Perchlorate Characterization Work Plan**

DTSC’S REQUIREMENTS FOR WORK PLAN	OBJECTIVE OF PROPOSED SCOPE OF WORK	APPLICABLE EXISTING WORK PLANS	PROPOSED SCOPE OF WORK	RFI OPERABLE UNIT PROGRAM
1. Install additional groundwater monitoring wells, position to best intercept potential perchlorate or other contaminant migration pathways	Evaluate potential perchlorate impacts from surface water transport along Northern Drainage from Building 359 site and potential impacts from landfills	5, 6, 9, 12	1. Install four near-surface groundwater monitoring wells, one north of Area I landfill, three north of Area II landfill. 2. Complete hydrophysical logs and discrete sampling of WS-12, WS-13 and WS-14 and 3-D groundwater flow model prior to determining need and/or location of any additional Chatsworth Formation wells.	1. Surficial media 2. Chatsworth formation
2. Test the aquifer	Evaluate potential groundwater transport of perchlorate across the Shear Zone and other faults and fine-grained stratigraphic members	1, 7	1. Perform pumping test at C-1. 2. Perform pumping test at WS-14 as a contingency depending upon results of C-1 pumping test, hydrophysical logs and discrete sampling of WS-12, WS-13 and WS-14.	1. and 2.: Chatsworth formation
3. Evaluate water quality and assess data from existing wells to characterize contaminant movement	Confirm that perchlorate is absent in OS-9. Determine if perchlorate and other chemicals are present in water supply wells and evaluate vertical concentration profiles. Evaluate potential surface water transport of perchlorate along Northern Drainage	Appendix B of this Work Plan	1. Collect weekly water samples from OS-9 for two months, monthly for 10 months and quarterly thereafter. Analyze all samples for perchlorate. Analyze for general minerals and for 18O and 2H monthly for 1st year and quarterly thereafter. 2. Characterize vertical flow regimes in WS-12, WS-13 and WS-14 using borehole hydrophysics and sample discrete intervals based on results and analyze for perchlorate, general minerals, volatile organic compounds and other constituents as appropriate.	1. Surficial media 2. Chatsworth formation
4. Map geology and review aerial photographs, review all existing hydrology data	Determine nature of stratigraphy in Simi Conglomerate and its lateral extent and effects of stratigraphy on groundwater occurrence and flow. Evaluate hydrogeology along Northern Drainage. Assess nature of potential surface water flows.	7	1. Geology along Northern Drainage to be mapped in additional detail from northern SSFL property boundary. Includes inspection, analysis and interpretation of aerial photos and photo documentation of key geologic features. 2. All existing hydrogeologic data provided in 2000 technical memorandum to be reviewed and summarized. Additional hydrogeologic data collected as part of this work plan will also be incorporated. 3. Characterize surface water flows from Northern and Eastern Drainages.	1, and 2. Chatsworth formation 3. Surficial media
5. Assess available remediation technologies for interim measures to reduce or contain perchlorate	Identify and evaluate potential remedial technologies for perchlorate and other COCs in groundwater.	None.	1. Prepare and submit corrective measures study work plan consistent with 22 CCR 66264.101 and Attachment E of the Post-Closure Permit.	Surficial media and Chatsworth formation
6. Other characterization activities – Quarterly sampling of all off-site groundwater monitoring wells and springs currently in program for perchlorate and general minerals	Evaluate potential groundwater transport of perchlorate across the Shear Zone and other faults and fine-grained stratigraphic members. Evaluate potential surface water transport of perchlorate along Northern Drainage.	2, 3, 4, 8	1. Collect groundwater samples quarterly from WS-4A, WS-9B, RD-37, RD-45A, RD-45B, RD-45C, RD-51A, RD-51B, RD-51C, RD-52A, RD-52B, RD-52C, RD-70, and PZ-62 and four new wells to be installed at landfills. Analyze all samples for perchlorate and general minerals. Collect samples quarterly from all off-site wells currently in the site-side groundwater monitoring program and analyze for perchlorate and general minerals. 2. Collect samples from six springs and seeps along the Northern Drainage twice annually, once in the late spring and again in the early fall. Analyze samples for perchlorate, general minerals and 18O and 2H. If perchlorate is detected in spring/seep, collect samples of alluvium/colluvium and/or rock and submit for perchlorate analysis. Collect samples twice annually from all off-site springs/seeps currently in the site-side groundwater monitoring program and analyze for perchlorate and general minerals.	Surficial media and Chatsworth formation
7. Other characterization activities – Characterize soil and groundwater conditions in surface drainage beginning at SSFL and leading to Bathtub Well #1. Collect samples at minimum intervals of 1,000 feet at surface, alluvium/colluvium-bedrock interface and collect water samples if water encountered in boring.	Evaluate potential surface water transport of perchlorate along Northern Drainage	9, 10, 11	1. Collect sediment leachate samples from surficial and deeper sediments from more than 60 locations within the active channel of the Northern Drainage mostly using an enhanced field leaching procedure. Lateral spacing near RFI sites to range from 50 to 125 feet. Spacing to increase with distance from RFI sites. Spacing ranging from 250 to 500 feet to be used on SSFL property, and ranging from 500 to 1,000 feet off-site, with no distance exceeding 1,000 feet. Samples to be collected from all locations at 0-1/2” and at 6” above bedrock. Collect sample from 0.5-4” at ~10 percent of locations. Collect additional samples at locations where salt deposits are noted from channel and bank. At locations where sediment deposits are thick, collect overbank samples and samples at 6” intervals to bedrock. Collect sample of water if encountered in boring. 2. Collect one-time surface water samples from approximately 9 pools identified during inspections of the Northern Drainage. Analyze samples for perchlorate, general minerals and <sup>18</sup> O and <sup>2</sup> H. 3. Collect periodic surface water samples from one location within the Northern Drainage near the SSFL property boundary during the rainy season in accordance with the requirements specified by the RWQCB. Analyze samples for perchlorate.	1., 2., and 3.: Surficial media

Notes:

**TABLE 3**  
**SUMMARY OF DTSC’S WORK PLAN REQUIREMENTS AND PROPOSED SCOPE OF WORK**  
**Santa Susana Field Laboratory, Perchlorate Characterization Work Plan**

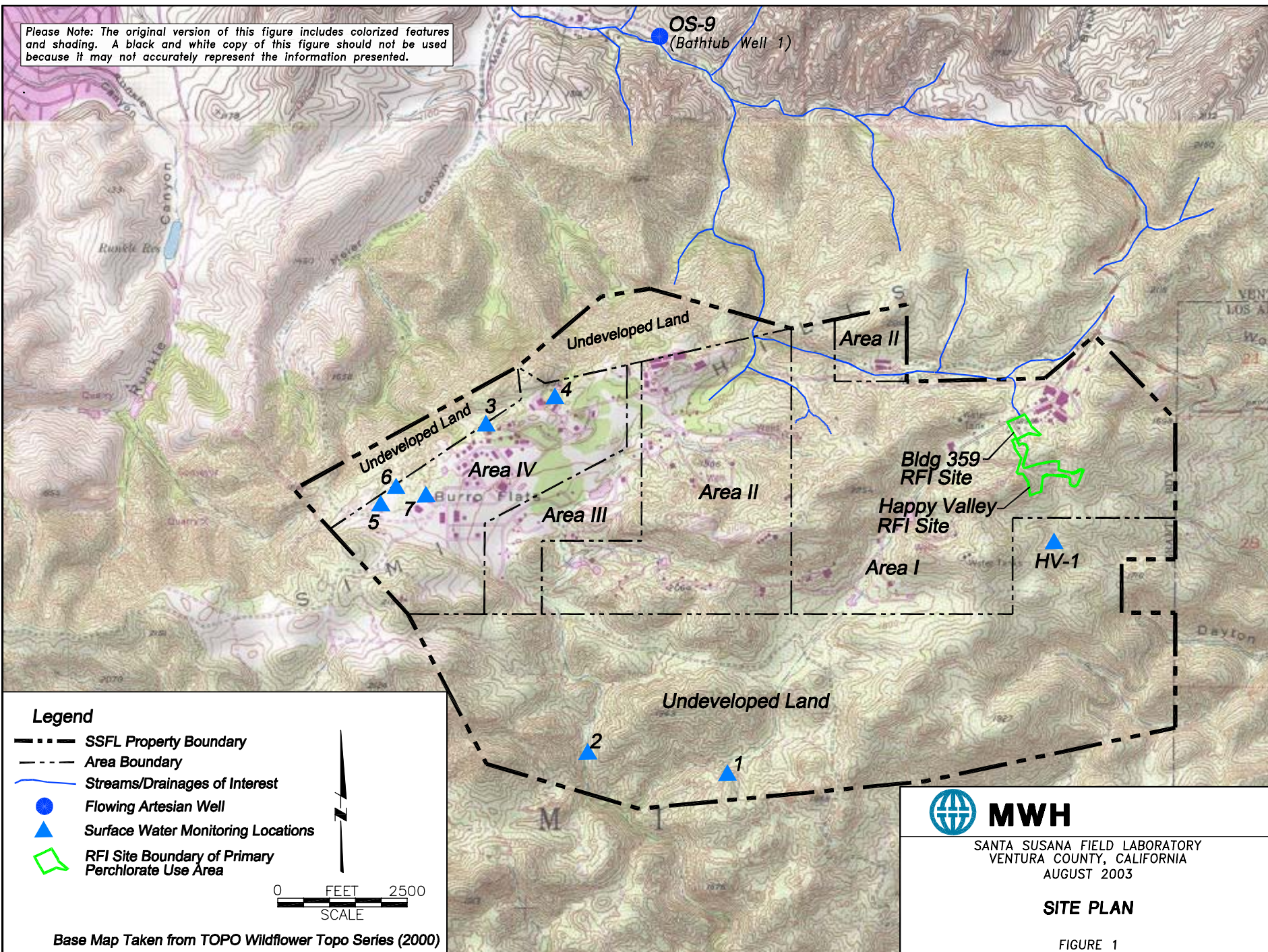
Existing Work Plans.

- 1. CFOU Work Plan Supplemental for Corehole C-1 Pumping Test, Santa Susana Field Laboratory, Ventura County, California. May 2003, The Boeing Company.
- 2. Site-Wide Sampling and Analysis Plan, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division. May 3, 1995, GRC
- 3. Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit PC-94/95-3-02, Area II, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division. June 5, 1995, GRC.
- 4. Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit PC-94/95-3-03, Areas I and III, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division. June 5, 1995, GRC.
- 5. Proposed Designs for Drilling, Construction and Testing of Additional Monitor Wells at the Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory, Ventura County, California. June 28, 1995, GRC.
- 6. Modifications to Monitor Well Drilling and Construction Plan Titled: Proposed Designs for the Drilling, Construction and Testing of Additional Monitor Wells at the Santa Susana Field Laboratory. November 6, 1996, GRC.
- 7. Work Plan for Additional Field Investigations, Chatsworth Formation Operable Unit. Revision 1. October 2000, Montgomery Watson.
- 8. Spring and Seep Sampling Work Plan. Santa Susana Field Laboratory, Ventura County, California. March 2002, MWH.
- 9. RCRA Facility Investigation, Work Plan Addendum Amendment, Area 1 and Area II Landfills Investigation Work Plan, SWMU 4.2 and SWMU 51., Santa Susana Field Laboratory, Ventura County, California. June 2003, MWH.
- 10. RCRA Facility Investigation Work Plan Addendum Amendment, Santa Susana Field Laboratory, Ventura County, California. June 2000, Ogden.
- 11. Final RCRA Facility Investigation Work Plan Amendment Addendum, Santa Susana Field Laboratory, Ventura County, California, Appendix A. October 2000, Ogden
- 12. Final RCRA Facility Investigation Shallow Zone Groundwater Investigation Work Plan, Santa Susana Field Laboratory, Ventura County, California. December 2000, Ogden.

CCR	California Code of Regulations
<sup>2</sup> H	deuterium
<sup>18</sup> O	oxygen-18
RFI	Resource Conservation and Recovery Act (RCRA) Facility Investigation
RWQCB	Regional Water Quality Control Board
SSFL	Santa Susana Field Laboratory

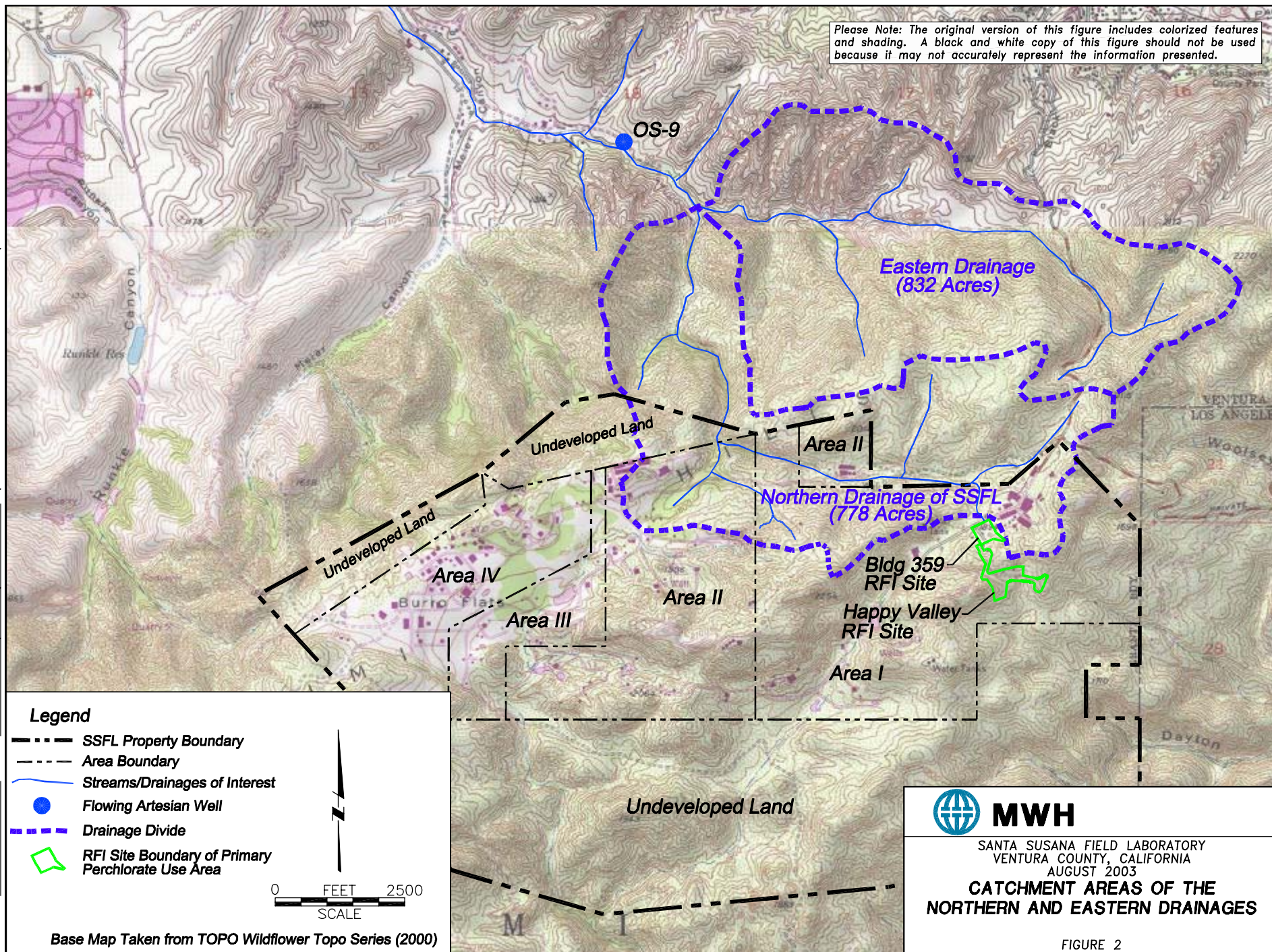


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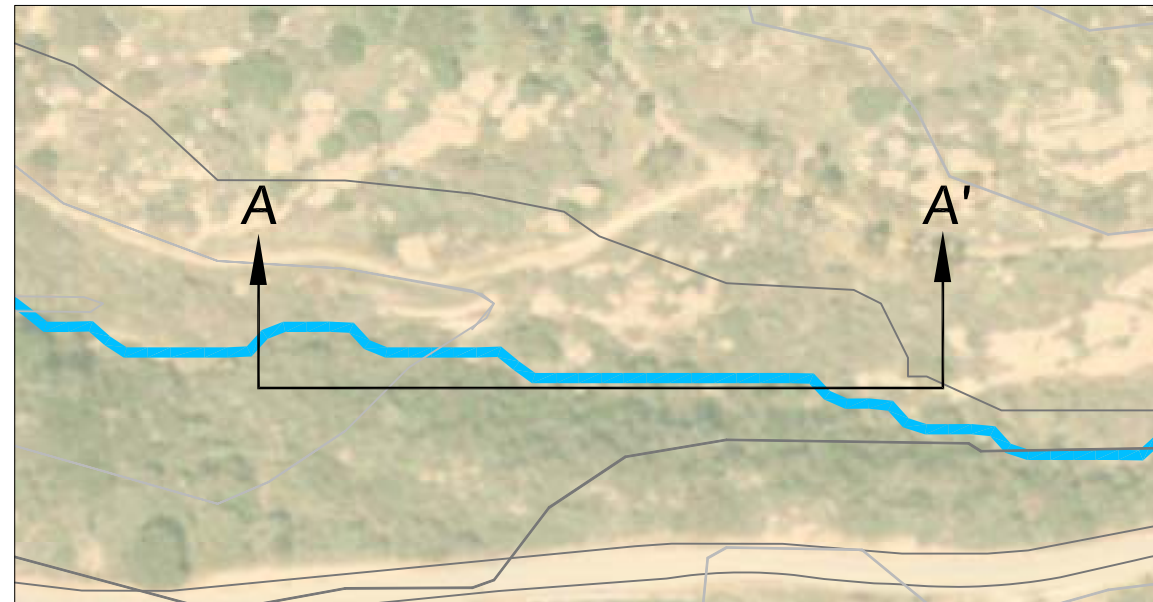




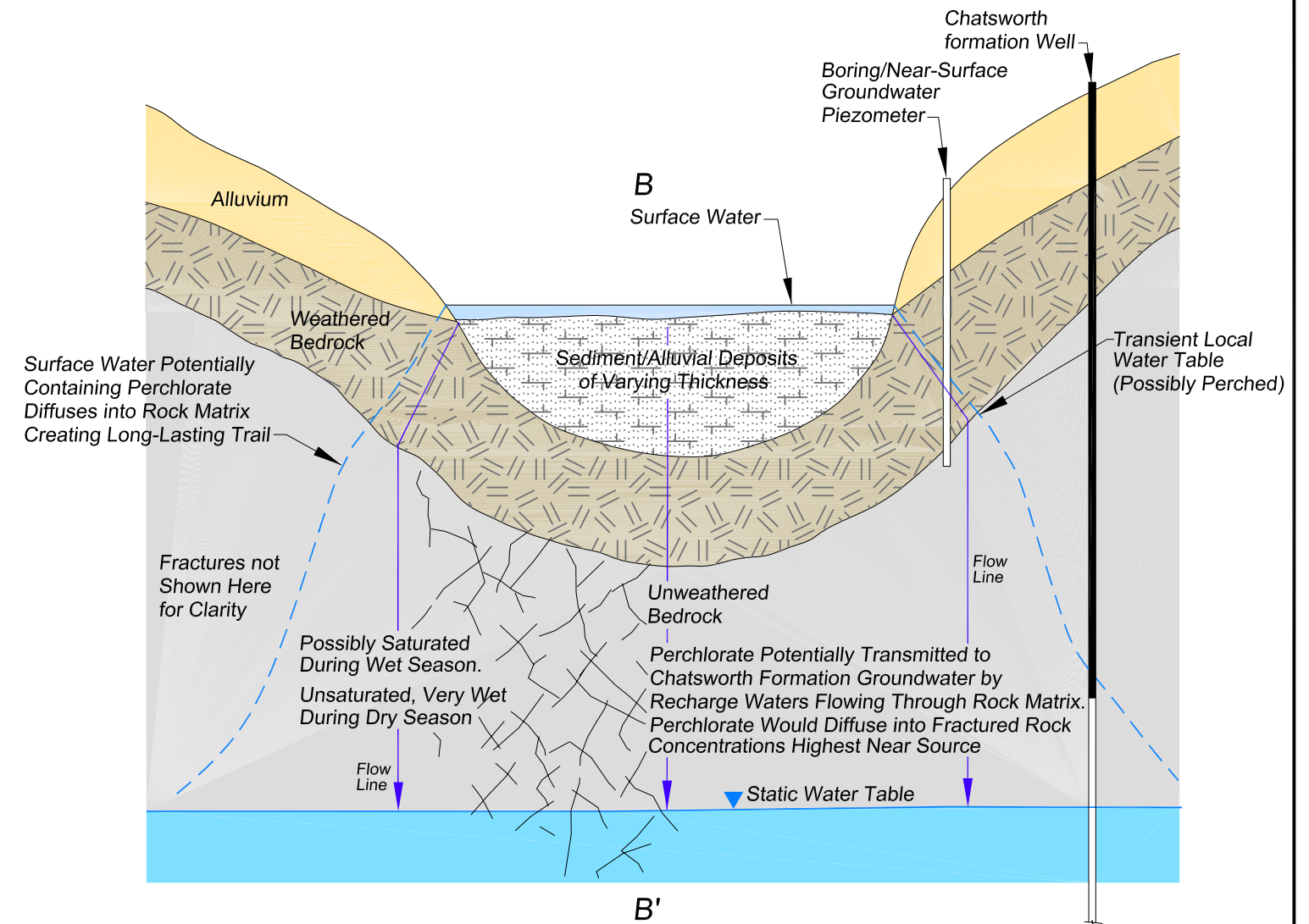
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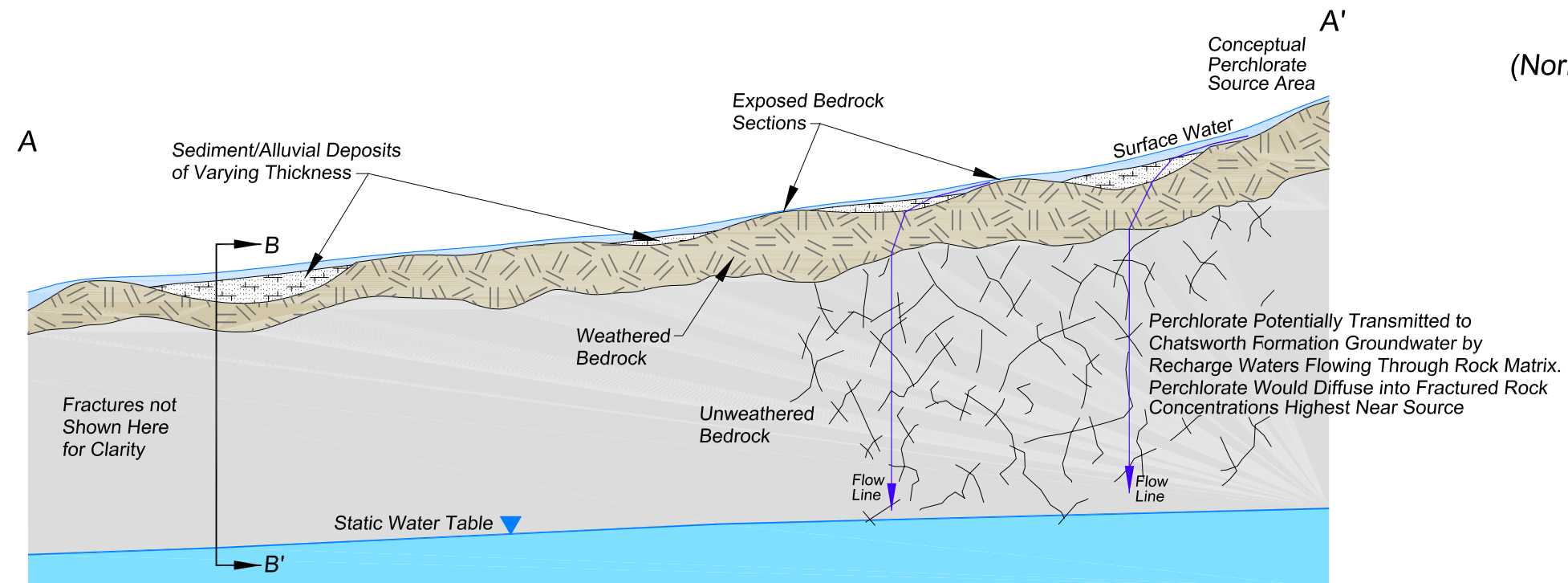




Conceptual Plan View



Section B-B'  
(Normal to Drainage, Not to Scale)



Section A-A'  
(Longitudinal Section, Not to Scale)

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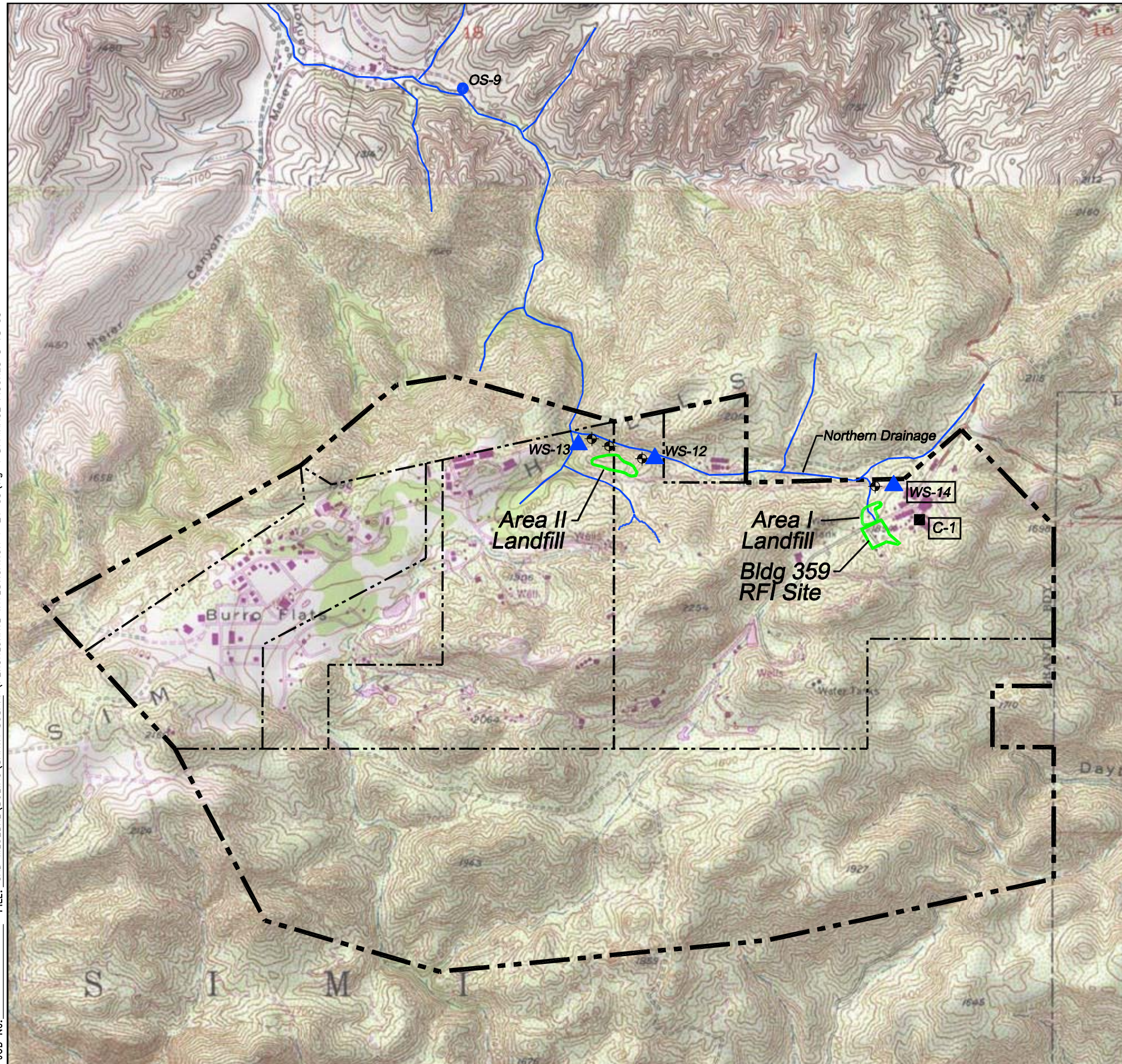


SANTA SUSANA FIELD LABORATORY  
VENTURA COUNTY, CALIFORNIA  
AUGUST 2003

**CONCEPTUAL DIAGRAM OF  
POTENTIAL PERCHLORATE TRANSPORT  
AT THE NORTHERN DRAINAGE**

FIGURE 3





### Perchlorate Characterization Work Plan Summary

- Sample Northern Drainage Sediments from 60 Locations & Analyze for Perchlorate
- Sample Surface Water Periodically at 1 On-site Location on Northern Drainage as Required by RWQCB. Analyze for Perchlorate. Collect One-time Samples Along Northern Drainage Analyze for Perchlorate, General Minerals and  $^{18}\text{O}$  &  $^2\text{H}$
- Sample Springs/Seeps Twice Annually. Six Locations Along Northern Drainage, and Other Current Off-Site Locations. Analyze for Perchlorate, General Minerals,  $^{18}\text{O}$  &  $^2\text{H}$
- Sample OS-9 Weekly for 2 Months, Monthly for 10 Months and Quarterly Thereafter. Analyze All Samples for Perchlorate, Monthly and Quarterly Samples for General Minerals,  $^{18}\text{O}$  &  $^2\text{H}$
- Sample 5 Near-Surface, 11 Chatsworth, & 2 Water Supply Wells & Current Off-Site Locations Quarterly. Analyze for Perchlorate & General Minerals
- Hydrophysically Log & Sample 3 Water Supply Wells. Analyze for Perchlorate & VOCs
- Install 4 Near-Surface Groundwater Monitoring Wells
- Perform Pumping Test at C-1 and Possibly WS-14
- Characterize Geology, Hydrogeology & Hydrology
- Submit Corrective Measures Study Workplan

### Legend

- SSFL Property Boundary
- Area Boundary
- Streams/Drainages of Interest
- Flowing Artesian Well
- ▲ Water Supply Well to be Hydrophysically Logged
- ⊕ Proposed Near-Surface Groundwater Monitoring Wells
- Corehole Location
- C-1 Proposed Pumping Test location
- RFI Site Boundary of Interest

Base Map Taken from TOPO Wildflower Topo Series (2000)



**MWH**  
SANTA SUSANA FIELD LABORATORY  
VENTURA COUNTY, CALIFORNIA  
AUGUST 2003

**SUMMARY OF PROPOSED  
SCOPE OF WORK**

FIGURE 4





## Department of Toxic Substances Control



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Agency Secretary  
California Environmental  
Protection Agency

Edwin F. Lowry, Director  
8800 Cal Center Drive  
Sacramento, California 95826-3200

Gray Davis  
Governor

June 23, 2003

Mr. Steve Lafflam  
The Boeing Company  
Rocketdyne Propulsion & Power  
6633 Canoga Avenue  
Post Office Box 7922  
Canoga Park, California 91309-7922

### SUBMITTAL OF WORKPLAN TO CHARACTERIZE POTENTIAL MIGRATION OF PERCHLORATE CONTAMINATION TO OFFSITE AREAS, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA

Dear Mr. Lafflam:

The purpose of this letter is to require submittal of a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Workplan (Workplan) pursuant to the November 12, 1992 Stipulated Enforcement Order (Health and Safety Code section 25187). The Workplan shall describe measures to be taken to investigate the potential migration of perchlorate contamination from the Santa Susana Field Laboratory (SSFL) to offsite areas, such as Brandeis-Bardin Institute property.

Perchlorate has been detected in Bathtub Well 1 at the Brandeis-Bardin Institute property. Bathtub Well 1, located approximately 4,700 feet north of the SSFL, consists of a pipe with flowing water at a livestock-drinking trough. The pipe is fed by a flowing artesian well adjacent to the trough. On May 28, 2003 the Department of Toxic Substances Control (DTSC) was first made aware of the presence of perchlorate at Bathtub Well 1, at a concentration of 62 micrograms per liter ( $\mu\text{g/L}$ ). In a water sample collected by Ventura County on February 21, 2003. On May 30, 2003 DTSC staff collected two samples from Bathtub Well 1 (one duplicate for Quality Assurance/Quality Control). Laboratory analyses of the samples reported 140 and 150  $\mu\text{g/L}$ . Prior to the sampling events in February by Ventura County and in May by DTSC, a sample collected from the same well by DTSC staff on March 20, 2002 did not contain detectable concentrations of perchlorate.

*The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web site at [www.dtsc.ca.gov](http://www.dtsc.ca.gov).*

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Mr. Steve Lafflam  
June 23, 2002  
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(less than 3 ug/L). DTSC collected additional samples from four wells on the Brandels-Bardin property on June 11, 2003; the results for Bathtub Well 1 show perchlorate at 39 and 36 ug/L. Results from the other three wells (Bathtub Well 2, OS-1, and OS-2) sampled June 11, 2003, were less than 3 ug/L.

### **Previous Perchlorate Investigations - Simi Valley**

Perchlorate was detected in the shallow groundwater at Simi Valley in 1999. At that time, DTSC initiated an extensive effort to collect and analyze a large volume of offsite samples to determine if the perchlorate detections in Simi Valley were associated with the known perchlorate impacts at the site. The actions taken by DTSC included: collecting spring/seep samples from known locations around the site; collecting split groundwater samples from SSFL onsite and offsite wells; coordinating with the Regional Water Quality Control Board - Los Angeles Region (RWQCB-LAR) in collecting and analyzing groundwater samples from existing gasoline service station wells in Simi Valley for perchlorate; collecting soil samples from the surface water drainages; and collecting surface water runoff samples. To date, DTSC and RWQCB-LAR have collected over 210 samples as part of this effort. Based on this extensive offsite sampling effort along with the additional historical onsite perchlorate data, DTSC could not clearly establish a link between the onsite releases and the perchlorate detections in Simi Valley. It should be noted, the "hits" of perchlorate in Simi Valley are located approximately 3 to 5 miles from the northernmost SSFL facility boundary.

### **Additional Perchlorate Investigations - Onsite/Offsite**

The recent confirmed detection of perchlorate in Bathtub Well 1 suggests that the perchlorate contamination from SSFL may have migrated offsite to the Brandels-Bardin property based on the following rationale:

1. Perchlorate has been detected onsite at SSFL with the highest reported concentration found in groundwater at Happy Valley Area at a concentration of 1,600 ug/L. Happy Valley is located approximately two miles from the Bathtub Well 1 location.
2. Bathtub Well 1 is within 1 mile geologically down-dip and topographically down slope of the facility.
3. The area between SSFL and Bathtub Well 1 is relatively pristine land with minimal anthropogenic impacts; therefore, the presence of other or contributing sources of perchlorate, beyond those identified at SSFL is unlikely.



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4. The well feeding Bathtub Well 1 is under artesian conditions. The recharge zone for groundwater at this well would therefore be located further up-slope closer to SSFL.

A connection between the perchlorate releases at SSFL and the detections in Simi Valley still remains indeterminate, even with the new data. However, based on the perchlorate detections at Bathtub Well 1 and the rationale provided above, DTSC hereby requires The Boeing Company (Boeing) to submit the Workplan to investigate the potential of offsite migration of perchlorate contamination from the facility. The Workplan should also address additional onsite investigation of groundwater and must address all potential surface water and groundwater pathways originating from SSFL.

**At a minimum, the scope of work should include:**

- Additional DTSC-approved groundwater monitoring wells positioned and constructed in a manner to best intercept potential perchlorate or other contaminant migration pathway(s). Since contaminant migration may have occurred at the site via both surface and groundwater pathways (or a combination of both), The additional investigation should not be based on the premise that contaminant migration would be prevented by geologic features such as faults and finer-grained stratigraphic units. However, the effects of faults and finer-grained units, specifically the Shear Zone and North Fault, should be evaluated through the installation of additional groundwater monitoring wells, aquifer testing, and the evaluation of water quality data to assess the nature of any effects on contaminant migration. Due to the complexities and inherent uncertainties associated with the groundwater flow at the site, several groundwater monitoring wells may be required. Wells may need to be installed in an iterative process. Data from the existing groundwater monitoring wells should be assessed in the areas between the known sources and Bathtub Well 1 to determine their value in characterizing the movement of contaminants. These wells may be altered or retrofitted as appropriate to provide more useful information. Multiple depth wells will be necessary to assess the effects of vertical gradients on the migration of perchlorate.
- Characterization of the hydrogeologic conditions present between known source areas at SSFL to the area of Bathtub well 1. In addition to installing new wells and retrofitting existing wells as discussed above, activities should include detailed geologic mapping, aerial photograph review, and the review of all existing hydrology data.



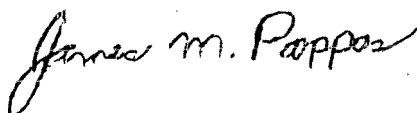
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- Assessment of available remediation technologies, to be used as Interim Measures, to reduce and/or contain perchlorate contamination with the objective of controlling further migration of perchlorate from identified source areas. Enhancement of the existing groundwater treatment system should also be evaluated.
- Quarterly sampling of all offsite groundwater monitoring wells, seeps, and springs currently @ the Boeing groundwater monitoring program for perchlorate and general chemistry parameters. Characterization of the soil and groundwater conditions in the surface drainage beginning at SSFL and leading to Bathtub Well 1 must be included. Characterization activities must include, but not be limited to, collecting soil samples in the natural drainages leading to the area of Bathtub Well 1, at a minimum of 1,000-foot intervals, at the surface and at the alluvium/colluvium and bedrock interface. If encountered, water samples must be collected from the soil borings. All samples shall be analyzed for perchlorate.

The Workplan shall be submitted to DTSC by August 18, 2003 for review, comment and subsequent approval. Upon completion of the Workplan activities, a report summarizing all soil, surface water, and/or groundwater sampling data collected during the investigation resulting from implementation of the Workplan and any prior soil and groundwater investigations shall also be submitted to DTSC. The report shall include the conclusions from this investigation, recommendations for additional investigations as necessary, and plans for actions to be taken for site remediation and/or source control as needed. These actions should be in addition to those outlined in the Happy Valley Interim Measures (HVIM) Workplan Addendum dated June 16, 2003, submitted pursuant to DTSC's May 21, 2003 letter. DTSC is currently reviewing the HVIM workplan and HAJJbe forwarding comments, which may include additional HVIM activities to those proposed by Boeing in the Workplan.

If you have any questions, please do not hesitate to contact me at (916) 255-3574.

Sincerely,



James M. Pappas, P.E., Chief  
Northern California Permits and Corrective Action Branch

Mr. **Steve** Lafflam  
June 23, 2003  
Page 5

cc: Mr. Dave Bachorowski  
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Faxed July 16, 2003

July 16, 2003

In reply refer to 2003RC02569



James M. Pappas, P.E., Chief  
Northern California Permits and Corrective Action Branch  
California Environmental Protection Agency  
Department of Toxic Substances Control  
8800 Cal Center Drive  
Sacramento, CA 91309-7922

Subject: Off-site Perchlorate Sampling at Brandeis-Bardin Institute  
Santa Susana Field Laboratory  
Ventura County, California

RE: Well OS-09

Dear Mr. Pappas:

The Boeing Company, Rocketdyne (Rocketdyne) hereby submits the proposed activities and methodologies for the sampling and analysis of perchlorate in groundwater from a well off-site of the Boeing Santa Susana Field Laboratory (SSFL). The period of work will be July and August 2003. The site to be sampled is well OS-9 on Brandeis-Bardin Institute (BBI) property in Ventura, California. BBI is located north and northwest of SSFL.

The water quality samples will be collected on a weekly basis through August 2003 by Haley & Aldrich, Inc.

Water samples will be submitted each week for the analysis of perchlorate using EPA method 314. Water samples will also be submitted weekly for the analysis of general mineral constituents. General mineral constituents will include major anions (carbonate, bicarbonate, chloride, and sulfate), major cations (calcium, magnesium, sodium, and potassium), nitrate, electrical conductivity, total dissolved solids, and pH. Twice during the project period, water samples will be submitted for analysis of deuterium and oxygen-18.

Water samples collected for perchlorate and general mineral constituents will be submitted to:

**Del Mar Analytical**  
2852 Alton Avenue  
Irvine, CA 92606



Each water sample collected for analysis of perchlorate will also be submitted (split) to:

**Ceimic Corporation**  
10 Dean Knauss Drive  
Narragansett, RI 02882

Samples collected for deuterium and oxygen-18 will be submitted to the **University of Ottawa** for analysis:

G. G. Hatch Isotope Laboratories  
University of Ottawa (Earth Sciences)  
140 Louis Pasteur  
Ottawa, Ontario Canada K1N 6N5

LOCATION IDENTIFIER	SOURCE TYPE	ANALYSIS FREQUENCY			
		Deuterium & Oxygen-18 (U of Ottawa)	Perchlorate (Del Mar & Ceimic)	General Minerals (Del Mar)	Flow Rate, Field Parameters
OS-9	Groundwater	Twice	Weekly	Weekly	Weekly

During sample collection, a second duplicate set of water samples for analysis of perchlorate will be collected for submittal to Del Mar and Ceimic. The laboratories will be instructed to "hold" these samples pending instruction based on the results of analysis of the initial samples. A blind duplicate set of water samples for analysis of perchlorate will also be collected for submittal to both Del Mar and Ceimic. In the event perchlorate is detected in an initial sample or blind duplicate, both laboratories will be instructed to analyze the duplicate "held" samples. All analyses will be conducted pursuant to EPA protocols (Test Methods for Evaluating Solid Waste (SW-846).

A blind field blank will be prepared and submitted to Del Mar and Ceimic during sample collection. The field blank sample will consist of de-ionized water provided by Del Mar Analytical and will be prepared by the sampling crew under normal sampling conditions at the same time the regular water quality samples are collected. QA/QC procedures as described in SW-846 will be implemented.





Both Del Mar Analytical and Ceimic will be requested to conduct a "matrix specific method detection limit study" using groundwater from well OS-9. The matrix specific method detection limit studies will be conducted following the procedures identified in Code of Federal Regulations, 40 CFR, Appendix B, Part 136 -- Definition and Procedure for the Determination of the Method Detection Limit -- Revision 1.11. It will consist of analyzing seven (7) representative samples of the groundwater from well OS-9 with perchlorate spiked at the concentration equivalent to the lowest calibration standard used in the quantification of the results.

Perchlorate blind-spike samples will be submitted to each laboratory once during the project period. The samples will consist of both de-ionized water samples and groundwater samples from well OS-9 spiked with perchlorate at a concentration of 5 micrograms per liter. The spikes will be prepared by Environmental Resource Associates (ERA) of Arvada, Colorado. ERA's DI water has been analytically verified to be free of perchlorate at a detection limit of 0.5 µg/L by an independent laboratory. ERA will combine the groundwater from well OS-9 into a pre-rinsed poly carboy. A perchlorate spiking concentrate (1.00 mg/L) has been prepared and analytically verified by ERA. This concentrate will be used to spike the project samples at a concentration of 5 micrograms per liter. Class A volumetric glassware and NIST traceable calibrated balances will be used in the manufacture of these samples. Samples will be packaged by ERA in pre-rinsed bottles which will be the same as those used for the groundwater samples.

All activities will be conducted pursuant to current, approved sampling and analysis plans prepared by Groundwater Resources Consultants, Inc. for monitoring activities at SSFL: *"Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit PC-94/95-3-02, Area II, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division"* and *"Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit PC-94/95-3-03, Areas I and III, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division,"* both dated June 5, 1995.

Data will be provided to your office as validated results are made available to Boeing. Following the completion of the two month sampling program, a summary report will be presented to DTSC including all analytical results.

The California Department of Toxic Substances Control (DTSC) will be notified of the schedule for sampling to allow for a representative to be present to collect samples for independent analysis during the sampling period.

J. Pappas (2003RC02569)

July 16, 2003

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If you have any questions, please call me at (818) 586-5695.

Sincerely,



Art Lenox  
Environmental Remediation



AJL:DHC:bjc

cc: Gerard Abrams, DTSC, Sacramento  
Pauline Batarseh, DTSC, Sacramento  
Barbara Coler, DTSC, Sacramento  
Dave Bacharowski, CRWQCB, LA  
Karen Baker, DTSC, Cypress  
John Varble, Brandeis Bardin Institute

(SHEA-097857)



Haley & Aldrich, Inc.  
326 South Wilcox, Suite A 200  
Tucson, AZ 85711-4029  
Tel: 520.326.1898  
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15 August 2003  
File No. 26473M -435

The Boeing Company  
Rocketdyne Propulsion & Power  
6633 Canoga Avenue D /393 T/487  
P.O. Box 7930  
Canoga Park, California 91303

Attention: Art Lenox

Subject: WELLOS-09 (Bathtub Well No. 1) Sampling Summary  
Ventura County, California

Dear Mr. Lenox:

OFFICES

Boston  
Massachusetts

Cleveland  
Ohio

Dayton  
Ohio

Detroit  
Michigan

Hartford  
Connecticut

Kansas City  
Kansas

Los Angeles  
California

Manchester  
New Hampshire

Newark  
New Jersey

Portland  
Maine

Rochester  
New York

San Diego  
California

Santa Barbara  
California

Washington  
District of Columbia

This document summarizes the results of groundwater sampling and analysis activities conducted for The Boeing Company, Rocketdyne (Rocketdyne) at well OS-09 during the period July 2 through August 12, 2003.

Well OS-09 is located off-site of the Boeing Santa Susana Field Laboratory (SSFL) on Brandeis-Bardin Institute (BBI) property in Ventura County, California. BBI is located north and northwest of SSFL. Well OS-09 has also been referred to as Brandeis-Bardin Institute "bathtub well no. 1".

Well OS-09 is a flowing, artesian well and was producing approximately 0.3 liters per minute continuously during the sampling period.

WELLOS-09 SAMPLING ACTIVITIES

Haley & Aldrich, Inc. conducted weekly sampling and analysis of groundwater from well OS-09 beginning July 2, 2003. Sample collection was performed on July 2, July 10, July 17, July 24, July 31, August 7, and August 12. During the July 24 and 31, and August 12 sampling events, sampling was also conducted by Mr. Peter Bailey of the California Department of Toxic Substances Control.

Water samples were submitted each week for the analysis of perchlorate using EPA method 314.0 Determination of Perchlorate in Drinking Water Using Ion Chromatography (Table I). Water samples were also submitted weekly for the analysis of general mineral constituents. General mineral constituents include major anions (carbonate, bicarbonate, chloride, and

sulfate), major cations (calcium, magnesium, sodium, and potassium), nitrate, electrical conductivity, total dissolved solids, and pH (Table II). Twice during the project period (on July 2 and 17, 2003), water samples were submitted for analysis of deuterium and oxygen-18.

Weekly water samples collected for perchlorate and general mineral constituents were submitted to:

DelMar Analytical  
2852 Alton Avenue  
Irvine, CA 92606, and

Water samples for analysis of perchlorate were also submitted to:

Cemtec Corporation  
10 Dean Knauss Drive  
Narragansett, RI 02882

A third sample set was collected on July 31 and submitted for analysis of perchlorate to:

American Analytics  
9765 Eton Avenue  
Chatsworth, CA 91311

Samples collected for deuterium and oxygen-18 were submitted to the University of Ottawa for analysis:

G. G. Hatch Isotope Laboratories  
University of Ottawa (Earth Sciences)  
140 Louis Pasteur  
Ottawa, Ontario Canada K1N 6N5

#### Quality Control/Quality Assurance Samples

Control samples consisting of duplicates, blanks, and spikes were submitted for analyses with the primary groundwater samples from well OS-09 beginning with the samples collected July 10.

A duplicate water sample for analysis of perchlorate was collected and submitted to each laboratory.

A second duplicate water sample for analysis of perchlorate was also collected and submitted to each lab. The laboratories were instructed to "hold" these samples pending instruction based



on the results of analysis of the initial samples. In the event perchlorate was detected in an initial sample or blind duplicate, both laboratories would have been instructed to analyze the duplicate "held" samples.

A field blank was prepared during sample collection and submitted to each laboratory conducting perchlorate analyses. The field blank samples consisted of de-ionized water provided by DelMar Analytical. Field blanks were prepared by the sampling crew under normal sampling conditions at the same time the regular perchlorate samples are collected from well OS-09.

#### A. Perchlorate Matrix Spike Samples

Perchlorate spike samples were submitted to DelMar Analytical and Cimic Corporation on July 17. The spike samples consisted of both de-ionized water samples and groundwater samples from well OS-09 spiked with perchlorate at a concentration of 5.0 micrograms per liter ( $\mu\text{g/l}$ ). The spikes were prepared by Environmental Resource Associates (ERA) of Arvada, Colorado using de-ionized water and groundwater collected from well OS-09 on July 10.

A second set of perchlorate spike samples were submitted to DelMar Analytical and Cimic Corporation on August 12. Again the spike samples consisted of both de-ionized water samples and OS-09 groundwater samples. The August 12 matrix spikes were prepared in the field, by a DelMar chemist, at the well OS-09 location. The matrix spikes were prepared using well OS-09 groundwater immediately after it was collected. The reagent de-ionized water spikes were prepared at the DelMar Analytical laboratory. The August 12 spikes were prepared at three concentrations (5.0  $\mu\text{g/l}$ , 50  $\mu\text{g/l}$ , and 150  $\mu\text{g/l}$ ). Reagent de-ionized water blanks were also prepared by DelMar Analytical.

#### B. Matrix Specific Method Detection Limit Study

DelMar Analytical and Cimic Corporation conducted "matrix specific method detection limit studies" using groundwater collected from well OS-09 on July 2, 2003. The matrix specific method detection limit studies were conducted following the procedures identified in: Code of Federal Regulations, 40 CFR, Appendix B, Part 136 – Definition and Procedure for the Determination of the Method Detection Limit – Revision 1.11.

The studies consisted of analyzing seven (7) representative samples of the groundwater from well OS-09 collected on July 10 with perchlorate spiked at the concentration equivalent to the lowest calibration standard used in the quantification of the results.

## WELL O S-09 SAMPLING RESULTS

Groundwater samples collected from well O S-09 were analyzed for the determination of perchlorate, general mineral constituents, and deuterium and oxygen-18.

### Perchlorate

Laboratory reports indicated that perchlorate was less than the detection limit in all primary groundwater samples and duplicate groundwater samples collected from well O S-09 by Haley & Aldrich. Perchlorate was also reported less than the detection limit in all field blanks prepared by Haley & Aldrich at well O S-09 (Table I). The detection limits were 0.8 microgram per liter ( $\mu\text{g/l}$ ) for the samples analyzed by DelMar Analytical, 0.35  $\mu\text{g/l}$  for samples analyzed by Ceimic Corporation, and 2  $\mu\text{g/l}$  for the samples analyzed by American Analytics.

The second duplicate water samples submitted to the laboratories with instructions to hold pending notification were not analyzed. These samples were not analyzed because the primary and duplicate sample perchlorate concentrations were all reported to be less than the detection limit.

### A. Perchlorate Matrix Spikes

#### 1. July 17 Samples

The reported perchlorate concentration in the 5.0  $\mu\text{g/l}$  groundwater matrix and reagent de-ionized water spike samples submitted with the July 17 groundwater samples ranged from 4.3 to 5.2 microgram per liter (Table I). Perchlorate was less than the detection limit in all reagent de-ionized water blanks analyzed. The detection limits were 0.8  $\mu\text{g/l}$  for DelMar Analytical, and 0.35  $\mu\text{g/l}$  for Ceimic Corporation.

#### 2. August 12 Samples

The reported perchlorate concentration in the 5.0  $\mu\text{g/l}$  field groundwater matrix and reagent de-ionized water spike samples submitted with the August 12 groundwater samples ranged from 4.2 to 4.6  $\mu\text{g/l}$  (Table I).

The reported perchlorate concentration in the 50  $\mu\text{g/l}$  field groundwater matrix and reagent de-ionized water spike samples submitted with the August 12 groundwater samples ranged from 49 to 49.9  $\mu\text{g/l}$ .

The reported perchlorate concentration in the 150  $\mu\text{g/l}$  field groundwater matrix and reagent de-ionized water spike samples submitted with the August 12 groundwater samples ranged

from 140 to 150 µg/L.

Perchlorate was less than the detection limit in all reagent de-ionized water blanks analyzed. The detection limits were 0.8 µg/L for DelMar Analytical, and 0.35 µg/L for Ceimic Corporation.

#### B. Matrix Specific Method Detection Limit Studies

The well OS-09 groundwater, matrix specific method detection limit study performed by DelMar Analytical supported the laboratory's method detection limit of 0.8 µg/L.

The matrix specific method detection limit study performed by Ceimic Corporation supported their method detection limit of 0.35 µg/L.

The laboratories did not report any significant matrix interferences for perchlorate analysis of well OS-09 groundwater.

#### General Mineral Constituents

Results of analyses by DelMar Analytical for general mineral constituents in groundwater samples collected from well OS-09 indicate the groundwater is sodium-bicarbonate type water (Table II). Sodium is the predominant cation in solution and bicarbonate is the predominant anion. Total dissolved solids content of the groundwater ranged from 570 to 640 milligrams per liter and the pH ranged from 8.26 to 8.64.

#### Deuterium and Oxygen-18

Results of analyses by G. G. Hatch Isotope Laboratories for the groundwater samples collected from well OS-09 on July 2 indicated deuterium and oxygen-18 delta values relative to standard mean ocean water were -49.9 and -9.7 permil, respectively.

Results of analyses for the groundwater samples collected July 17 indicate delta values were -51.1 and -9.41 permil for deuterium and oxygen-18, respectively.

The OS-09 groundwater ratio of the delta values for deuterium to oxygen-18 was greater than that of the global meteoric water line, and differed from measurements of other samples collected at SSFL including Chatsworth formation groundwater, rainfall, and Calleguas water. This suggests a different source for OS-09 water.

Copies of all laboratory reports for the analyses of groundwater and control samples associated with the well OS-09 sampling will be provided in a subsequent report following the completion of this program.



The Boeing Company  
15 August 2003  
Page 6

We appreciate the opportunity to provide environmental consulting services on this project.

Sincerely yours,  
HALEY & ALDRICH, INC.



Kurt J. Blust, R.G.  
Sr. Hydrogeologist



Sheldon Clark  
Vice President

Enclosures:

Table I: Summary of Preliminary Results for Perchlorate in Groundwater

Table II: Summary of Analyses for Inorganic Constituents in Groundwater

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TABLE I

SUMMARY OF PRELIMINARY RESULTS FOR PERCHLORATE IN GROUNDWATER FROM WELLS OS-09  
BOEING SANTA SUSANA FIELD LABORATORY  
VENTURA COUNTY, CALIFORNIA

SAMPLE IDENTIFIER	DATE	SAMPLE TYPE	LABORATORY	PERCHLORATE, micrograms per liter	ANALYTICAL METHOD	SAMPLERS	DATA VALIDATION
OS-09_070203_01	7/2/03	OS-09 Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_070203_03	7/2/03	OS-09 Groundwater	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071003_01	7/10/03	Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071003_02	7/10/03	OS-09 Groundwater Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071003_04	7/10/03	Field Blank	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071003_03	7/10/03	OS-09 Groundwater	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071003_03D	7/10/03	OS-09 Groundwater Duplicate	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071003_03F	7/10/03	Field Blank	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071703_01	7/17/03	OS-09 Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071703_02	7/17/03	OS-09 Groundwater Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071703_04	7/17/03	Field Blank	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071703_03	7/17/03	OS-09 Groundwater	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071703_03D	7/17/03	OS-09 Groundwater Duplicate	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071703_03F	7/17/03	Field Blank	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071703_06M1	7/17/03	5.0 ug/LM atrix spike	DelMar	4.8	314.0	Haley & Aldrich	AMEC
OS-09_071703_06R1	7/17/03	5.0 ug/L Reagent blank spike	DelMar	5.0	314.0	Haley & Aldrich	AMEC
OS-09_071703_06N1	7/17/03	Reagent blank	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071703_06MD1	7/17/03	5.0 ug/LM atrix spike Duplicate	DelMar	4.3	314.0	Haley & Aldrich	AMEC
OS-09_071703_06RD1	7/17/03	5.0 ug/L Reagent blank spike Duplicate	DelMar	5.2	314.0	Haley & Aldrich	AMEC
OS-09_071703_06ND1	7/17/03	Reagent blank Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_071703_06M3	7/17/03	5.0 ug/LM atrix spike	Ceim ic	4.9	314.0	Haley & Aldrich	AMEC
OS-09_071703_06R3	7/17/03	5.0 ug/L Reagent blank spike	Ceim ic	5.0	314.0	Haley & Aldrich	AMEC
OS-09_071703_06N3	7/17/03	Reagent blank	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_071703_06MD3	7/17/03	5.0 ug/LM atrix spike Duplicate	Ceim ic	4.98	314.0	Haley & Aldrich	AMEC
OS-09_071703_06RD3	7/17/03	5.0 ug/L Reagent blank spike Duplicate	Ceim ic	4.96	314.0	Haley & Aldrich	AMEC
OS-09_071703_06ND3	7/17/03	Reagent blank Duplicate	Ceim ic	<0.35	314.0	Haley & Aldrich	AMEC

TABLE I

SUMMARY OF PRELIMINARY RESULTS FOR PERCHLORATE IN GROUNDWATER FROM WELLS OS-09  
BOEING SANTA SUSANA FIELD LABORATORY  
VENTURA COUNTY, CALIFORNIA

SAMPLE IDENTIFIER	DATE	SAMPLE TYPE	LABORATORY	PERCHLORATE, micrograms per liter	ANALYTICAL METHOD	SAMPLERS	DATA VALIDATION
OS-09_072403_01	7/24/03	OS-09 Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_072403_02	7/24/03	OS-09 Groundwater Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_072403_04	7/24/03	Field Blank	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_072403_03	7/24/03	OS-09 Groundwater	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_072403_03D	7/24/03	OS-09 Groundwater Duplicate	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_072403_03F	7/24/03	Field Blank	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_073103_01	7/31/03	OS-09 Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_073103_02	7/31/03	OS-09 Groundwater Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_073103_04	7/31/03	Field Blank	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_073103_03	7/31/03	OS-09 Groundwater	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_073103_03D	7/31/03	OS-09 Groundwater Duplicate	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_073103_03F	7/31/03	Field Blank	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_073103_08	7/31/03	OS-09 Groundwater	American Analytics	<2.00	314.0	Haley & Aldrich	AMEC
OS-09_073103_08D	7/31/03	OS-09 Groundwater Duplicate	American Analytics	<2.00	314.0	Haley & Aldrich	AMEC
OS-09_073103_08F	7/31/03	Field Blank	American Analytics	<2.00	314.0	Haley & Aldrich	AMEC
OS-09_080703_01	8/7/03	OS-09 Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_080703_02	8/7/03	OS-09 Groundwater Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_080703_04	8/7/03	Field Blank	DelMar	<0.8	314.0	Haley & Aldrich	AMEC
OS-09_080703_03	8/7/03	OS-09 Groundwater	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_080703_03D	8/7/03	OS-09 Groundwater Duplicate	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_080703_03F	8/7/03	Field Blank	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_081203_01	8/12/03	OS-09 Groundwater	DelMar	<0.8	314.0	Haley & Aldrich	Pending
OS-09_081203_02	8/12/03	OS-09 Groundwater Duplicate	DelMar	<0.8	314.0	Haley & Aldrich	Pending
OS-09_081203_04	8/12/03	Field Blank	DelMar	<0.8	314.0	Haley & Aldrich	Pending
OS-09_081203_03	8/12/03	OS-09 Groundwater	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_081203_03D	8/12/03	OS-09 Groundwater Duplicate	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC
OS-09_081203_03F	8/12/03	Field Blank	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC



TABLE I

SUMMARY OF PRELIMINARY RESULTS FOR PERCHLORATE IN GROUNDWATER FROM WELLS-09  
BOEING SANTA SUSANA FIELD LABORATORY  
VENTURA COUNTY, CALIFORNIA

SAMPLE IDENTIFIER	DATE	SAMPLE TYPE	LABORATORY	PERCHLORATE, micrograms per liter	ANALYTICAL METHOD	SAMPLERS	DATA VALIDATION
OS-09_081203_06M1	8/12/03	5.0 ug/L Field Matrix spike	DelMar	4.2	314.0	Haley & Aldrich	Pending
OS-09_081203_06R1	8/12/03	5.0 ug/L Reagent blank spike	DelMar	4.6	314.0	Haley & Aldrich	Pending
OS-09_081203_06MD1	8/12/03	5.0 ug/L Field Matrix spike duplicate	DelMar	4.4	314.0	Haley & Aldrich	Pending
OS-09_081203_06M3	8/12/03	5.0 ug/L Field Matrix spike	Ceimic	4.508	314.0	Haley & Aldrich	AMEC
OS-09_081203_06R3	8/12/03	5.0 ug/L Reagent blank spike	Ceimic	4.621	314.0	Haley & Aldrich	AMEC
OS-09_081203_06MD3	8/12/03	5.0 ug/L Field Matrix spike duplicate	Ceimic	4.480	314.0	Haley & Aldrich	AMEC
OS-09_081203_06MB1	8/12/03	50 ug/L Field Matrix spike	DelMar	49	314.0	Haley & Aldrich	Pending
OS-09_081203_06RB1	8/12/03	50 ug/L Reagent blank spike	DelMar	49	314.0	Haley & Aldrich	Pending
OS-09_081203_06MBD1	8/12/03	50 ug/L Field Matrix spike duplicate	DelMar	49	314.0	Haley & Aldrich	Pending
OS-09_081203_06MB3	8/12/03	50 ug/L Field Matrix spike	Ceimic	49.797	314.0	Haley & Aldrich	AMEC
OS-09_081203_06RB3	8/12/03	50 ug/L Reagent blank spike	Ceimic	49.525	314.0	Haley & Aldrich	AMEC
OS-09_081203_06MBD3	8/12/03	50 ug/L Field Matrix spike duplicate	Ceimic	49.912	314.0	Haley & Aldrich	AMEC
OS-09_081203_06MC1	8/12/03	150 ug/L Field Field Matrix spike	DelMar	150	314.0	Haley & Aldrich	Pending
OS-09_081203_06RC1	8/12/03	150 ug/L Reagent blank spike	DelMar	150	314.0	Haley & Aldrich	Pending
OS-09_081203_06MCD1	8/12/03	150 ug/L Field Matrix spike duplicate	DelMar	150	314.0	Haley & Aldrich	Pending
OS-09_081203_06MC3	8/12/03	150 ug/L Field Matrix spike	Ceimic	141.433	314.0	Haley & Aldrich	AMEC
OS-09_081203_06RC3	8/12/03	150 ug/L Reagent blank spike	Ceimic	141.707	314.0	Haley & Aldrich	AMEC
OS-09_081203_06MCD3	8/12/03	150 ug/L Field Matrix spike duplicate	Ceimic	140.072	314.0	Haley & Aldrich	AMEC
OS-09_081203_06N1	8/12/03	Non-spiked reagent blank	DelMar	<0.8	314.0	Haley & Aldrich	Pending
OS-09_081203_06N3	8/12/03	Non-spiked reagent blank	Ceimic	<0.35	314.0	Haley & Aldrich	AMEC

## NOTE:

- 1) ALL RESULTS ARE PRELIMINARY PENDING DATA VALIDATION EXCEPT AS INDICATED.
- 2) < = Indicates Less Than, numerical value is the Method Detection Limit
- 3) All analyses performed using EPA METHOD 314 DETERMINATION OF PERCHLORATE IN DRINKING WATER USING ION CHROMATOGRAPHY.
- 4) AMEC = Indicates data validation performed by AMEC, no qualifications
- 5) Bold indicates groundwater samples.
- 6) Wells-09 has been also referred to a Brandeis-Bardine Institute "bathtub well no. 1".

TABLE II

SUMMARY OF PRELIMINARY RESULTS FOR INORGANIC CONSTITUENTS IN GROUNDWATER FROM WELL OS-09  
BOEING SANTA SUSANA FIELD LABORATORY  
VENTURA COUNTY, CALIFORNIA

Well Identifier			OS-09	OS-09	OS-09	OS-09	OS-09	OS-09	OS-09
Sampled Date			7/2/2003	7/10/2003	7/17/2003	7/24/2003	7/31/2003	8/7/2003	8/12/2003
Compound	Units	Method							
Calcium	mg/l	6010B	3.1	3.1	3.1	3 M 2	2.9	3	3.3
Magnesium	mg/l	6010B	1.9	1.9	1.9	1.8	1.8	1.8	1.9
Potassium	mg/l	6010B	2	0.95	1.2	1.5	1.2	1.2	1.2
Sodium	mg/l	6010B	200 M -HA	190	190 M -HA	190 M -HA	190 M -HA	190 M -HA	190 M -HA
Bicarbonate	mg/l	SM 2320B	317	317	305	268	329	pending	329
Carbonate	mg/l	SM 2320B	3.8	7.2	14.4	21.6	0	pending	2.4
Chloride	mg/l	300.0	26	28	26	28	26	26	26
Nitrate-N	mg/l	300.0	<0.072	<0.072	0.083 J	<0.072	<0.072	<0.072	<0.072
Sulfate	mg/l	300.0	130	120	130	140	130	140	130
Total Dissolved Solids	mg/l	160.1	570	580	580	640	570	580	580
pH	pH	150.1	8.42	8.6	8.64	8.56	8.29	8.26	8.39
Specific Conductance	umhos/cm	120.1	870	890	890	880	880	900	890
Laboratory			DMA	DMA	DMA	DMA	DMA	DMA	DMA

## NOTE:

- 1) M -HA = Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information.
- 2) M 2 = The MS and/or MSD were below the acceptance limits due to sample matrix interference.
- 3) J = Estimated value. Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL).  
The user of this data should be aware that this data is of unknown quality.
- 4) DMA = Del Mar Analytical of Irvine, California.
- 5) mg/L = Milligram per liter.
- 6) < = Not detected; numerical value represents the Method Detection Limit for that compound.
- 7) Well OS-09 has been also referred to a Brandeis-Bardine Institute "bathtub well no. 1".



AMEC chemists were requested to evaluate all available laboratory data from the sampling events associated with the OS-9 well (also known as Bathtub 1). These events included sampling on February 21, 2003 conducted by Ventura County, May 30, 2003 conducted by DTSC, June 11, 2003 conducted by DTSC, and weekly sampling by Haley & Aldrich beginning on July 2, 2003. The samples collected February 21<sup>st</sup> were analyzed by Weck Laboratories. The samples collected May 30<sup>th</sup> were analyzed by Advanced Technology Laboratories (ATL). The samples collected June 11<sup>th</sup> were analyzed by ATL and HML. The weekly samples that began on July 2<sup>nd</sup> were analyzed by Del Mar, the designated primary laboratory, and either Ceimic or American Analytics as the split lab.

Based upon a review of the available data, AMEC chemists have reason to question the validity of the detects reported by ATL in the May 30<sup>th</sup> and June 11<sup>th</sup> sampling events. Weck, in the February 21<sup>st</sup> sampling, and HME, in the June 11<sup>th</sup> sampling, each noted a peak in the sample chromatogram. HML spiked the sample with perchlorate to confirm that the unidentified peak was not perchlorate. Weck removed this perchlorate detect after a review of the data, requested by HML, as the peak was outside of the perchlorate retention time window. Subsequently, Del Mar, Ceimic, and American Analytics have also noted an unidentified peak (not perchlorate) in the OS-9 sample chromatograms. ATL also had a single peak in the OS-9 sample chromatograms. This peak fell within the perchlorate retention time window, but ATL did not perform matrix spikes to confirm the identification of perchlorate. As the samples from HML, Del Mar, Ceimic, and American Analytics have a single peak in the sample chromatograms that is not perchlorate, logic would question why two peaks, perchlorate and this unidentified peak, were not present in the ATL samples.

HML arranged to have both sets of samples from June 11<sup>th</sup> analyzed by TCMS. The ICMS analysis confirmed the nondetect results from HML and also confirmed the detects from ATL. Since these data contradict one another, one must look to other sources of error as the factor contributing to these inconsistencies. Such sources of error can include but are not limited to switching of the sample in the laboratory, inadvertent spiking of the sample in the laboratory, and the interval of time between the collection of the HML sample and the ATL sample. Other sampling events must also be considered in order to establish a bigger picture of the accuracy of the results.

In the weekly sampling of the OS-9 well, there have been no detects for perchlorate. There have been two separate, matrix-specific method detection limit studies that indicate that perchlorate is recoverable from the site water. There have been double-blind performance samples submitted to two of the three labs involved in the weekly sampling program which both laboratories passed. There have been duplicate field samples submitted to the laboratories with acceptable results. Lastly, both site water and deionized water samples were spiked with perchlorate at 5 ug/L, 50 ug/L, and 150 ug/L and Submitted to Ceimic, Del Mar, and the DTSC split lab along with unspiked site and deionized water. The results for all spiked samples submitted to Ceimic and Del Mar meet the Method 314.0 QC acceptance criterion of a matrix spike recovery within 80-120%.